EXPERIMENTAL AND NUMERICAL STUDY OF NITI HOLEY PLATES LOADED IN TENSION

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Cellard Christophe[(1)], Rio Gérard[(1)], S. Shariat Bashir [(2)], Liu Yinong[(2)], Grolleau Vincent[(1)], Delobelle Vincent[(3)], Favier Denis[(3)]

(1)Université de Bretagne Sud, Université Européenne de Bretagne, LimatB-Lab, BP 92116, 56321 Lorient cedex, FranceCity, (2)School of Mechanical and Chemical Engineering, The University of Western Australia, Crawley, LFM-lab, WA 6009, Australia, (3)Université de Grenoble (UJF, G-INP), CNRS UMR 5521, 3SR-Lab, BP 53, 38041 Grenoble, CEDEX, France, Country

chistophe.cellard@univ-ubs.fr, gerard.rio@univ-ubs.fr, bashirs@mech.uwa.edu.au, yinong.liu@uwa.edu.au, vincent.grolleau@univ-ubs.fr, vincent.delobelle@hmg.inpg.fr , denis.favier@grenoble-inp.fr,

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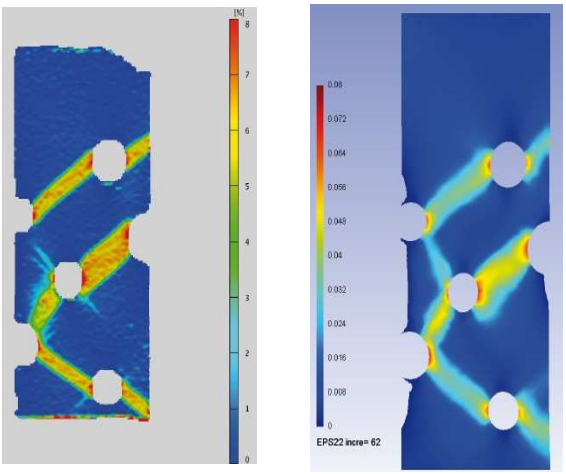
We present results of experiments and numerical modeling of superelastic deformation of NiTi holey plates. Ti-50.8at% rectangular plates of 110 mm x 29.5 mm in dimension and 0.1 mm and 1.5 mm in thickness are used for tensile testing and for simulation. Electrical discharge machining (EDM) was used to machine tensile specimens and to cut circular holes of different diameters in the plates.

The holey plate samples were loaded in uniaxial tension along the length direction at room temperature. A special apparatus was applied to confine out-of plane displacements in order to avoid buckling. The rate of deformation is sufficiently low to avoid thermal effect due to the release of latent heat. The 3D displacement field on the sample surface was recorded by means of 3D digital image correlation method (Aramis software), which also calculates the associated in-plane strain fields.

Material property parameters for the simulation are extracted from tensile, shear and bulge test experiments. Other remaining parameters required are selected from previous experiments or the literature. Simulation of the tensile deformation behaviour of the holey plates was conducted by means of finite element simulation based on a elasto-hysteretic tensorial model. Findings of the simulation were validated by comparison with the experimental data.

The objective of the work is firstly to get the whole data needed for a benchmark about a non-homogeneous test on NiTi, and secondly to investigate the capability of our numerical model [1].

In particular we compare the experimental and simulated results, for the global evolution of the structure «holey plate» and for the local evolution in non homogeneous area.



Example of comparison between experiment data (on the left) and simulation (on the right) for the same level of global vertical displacement.

[1]Gérard Rio, Denis Favier and Yinong Liu Elastohysteresis model implemented in the finite element sofware HEREZH++ DOI: http://dx.doi.org/10.1051/esomat/200908005